

Cephalic Conformation in Young Pyrenean Catalan Horses Shows no Differences between Sexes

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Abstract

'Sexual dimorphism' defines differences in dimensions and proportions between males and females and in case it appears, researches must be done to see if they are the result of ontogenetic scaling, heterochronic processes or allometric variations. In order to fill this gap in an Iberian local horse, breed, we studied nineteen fresh heads. They belonged to young purebred (registered) animals (11 males and eight females; average age 457 ± 37 days) of the Pyrenean Catalan Horse breed, nine linear parameters were obtained: (1) cranium width, (2) cephalic width, (3) face width, (4) cranium length, (5) frontal length, (6) head length, (7) ear length, (8) head height and (9) mandible length. Parameters (2) and (9) showed a non-N distribution. A Mann-Whitney test reflected no statistically significant sexual dimorphism. Having all studied horses under 36 months of age, it would be interesting to do more research with more and elder animals in order to have a better understanding of the growth dynamics for this breed.

Keywords: *Cavall Pirinenc Català*; Head morphology; Sexual dimorphism; Skull morphology

Introduction

Traditionally, ethnological description of animal domestic breeds have been based mainly on morphological traits, but they had to involve within and between variation analysis of three types: geographical, sexual, and ontogenetic (age-related). The assessment of non-purely morphological variation is a mere part to description of morphotype and the future delineation of prototype.

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Horses are sexually dimorphic animals, with a general pattern of males being larger than females. Most research on breeds of this species has been undertaken on a general biometrical basis of linear and angular measurements [3]. Studies of differences of adult males and females of the Minorca carried by the author reflected subtle differences mainly on dorsal neck conformation and distal part of extremities [4], and for the Mangalarga Marchador it was observed that head width provided evidence of sexual dimorphism, being larger in stallions [5]. But, although sexual dimorphism has been investigated at length for many equine breeds [6-9], few has been done in depth focusing in heads conformation. This research intended to assess differences in cephalic size between young males and females of an equine breed, the Catalan Pyrenean Horse (CPH). CPH is a livestock that is phenotypically heterogeneous, with a compact stocky body and has retained qualities of adaptation to the breed's living conditions: rusticity, sexual precocity, good fertility, easy births and good mothering aptitude [10]. They graze on the open range throughout the year based on a simple handling system: continuous pasturing, natural mating, unassisted births, foals raised with mares, and sudden weaning of 6-8-month old foals [10,11]. The aim of this research was to determine if there are sexual differences in head conformation. This research is very important for the environment because CPH horses are the unique equine breed in Catalonia and they are threatened [12]. Furthermore, the results of this study may be used to compare body measures and sexual dimorphism in other horse breeds.

Materials and Methods

Nineteen heads from young purebred (registered) animals (11 males and 8 females; average age 457 ± 37 days, range 393-583 days for males and 436-465 for females) belonging to the CPH breed and living in the same habitat were sampled from an industrial abattoir. After slaughtering of animals, heads were collected and measured when fresh. Nine morphometric standard cephalic parameters were analysed, including mandible: (1) cranium width, (2) cephalic width, (3) face width, (4) cranium length, (5) frontal length, (6) head length, (7) ear length, (8) head height and (9) mandible length. Measurements were obtained with a hypometer, except for (7), for which a flexible ruler was used. These bony measures correspond to those variables classically obtained in zooarchaeology and animal ethnology [13-15].

Numerical statistical analysis

A Shapiro-Wilk *W*-test was previously undertaken in order to determine if the data were normally distributed. Probability levels lower than 5% were considered to be significant ($p < 0.05$). As some of traits could show a non-normal distribution, the non-parametric Mann-Whitney test was performed to compare sexes. Data was analysed using the PAST-"Paleontological Statistics Software Package for Education and Data Analysis" software [16].

Ethics statement

No specific permits were required as this research involved the use of heads of animals which had been slaughtered for commercial purposes independent of the study goals.

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Received May 14, 2018; **Accepted** May 30, 2018; **Published** June 05, 2018

Citation: Pere PCM (2018) Cephalic Conformation in Young Pyrenean Catalan Horses Shows no Differences between Sexes. J Fisheries Livest Prod 6: 271. doi: [10.4172/2332-2608.1000271](https://doi.org/10.4172/2332-2608.1000271)

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	Cranium width	Head width	Face width	Skull length	Frontal length	Head length	Head depth	Mandible length	Ear length
Males									
Min	13.2	16.7	14	11.2	19.2	53.5	25	39.5	17
Max	18	22.5	18	19.5	26.5	60	29	46.5	20.5
Mean	15.2	20.2	15.5	15.5	22.6	56.8	26.5	42.1	18.6
Standard error	0.47	0.45	0.34	0.67	0.64	0.65	0.42	0.65	0.37
Standard deviation	1.56	1.51	1.11	2.21	2.12	2.16	1.4	2.14	1.22
Median	15	20.5	15.5	15.5	22.5	57	26.2	41.5	18.5
Females									
Min	11	14.5	15	14.5	21.5	54.5	26	39	15
Max	19.5	22	18	19.2	25	59	28.5	50	20.5
Mean	16.2	20.3	16.3	16.9	23	57.1	27	42.9	18.4
Standard error	0.99	0.88	0.35	0.59	0.35	0.55	0.38	1.33	0.66
Standard deviation	2.8	2.49	1	1.66	0.99	1.55	1.07	3.76	1.88
Median	16.2	21	16.1	16.65	23	57	26.7	42	18.2

Table 1: Main descriptive statistics for males (n=11) and females (n=8) belonging to the CPH breed. Lineal measurements are expressed in cm.

Results and Discussion

Table 1 gives the obtained main descriptive statistics. Cephalic width ($W=0.806$, $p=0.001$) showed a non-normal distribution. Mann-Whitney tests for each measurement reflected no statistically significant differences between sexes ($p>0.05$).

The results showed that the sex-based classification was not reliable, confirming the low sexual dimorphism in the skull measurements of this breed, suggesting no physiological and morphological variation in head (e.g., masticatory differences or agonistic behaviour) before sexual maturity. For instance, Lovsin et al. observed no sexual dimorphism in Lipizzan horses in early stages of post- foetal development. Being the age at which a female *Equus* gives birth to her first offspring is 3-3.5 years, the results cannot be viewed as significant for mature animals.

So, for a better understanding of the growth dynamics for this breed, additional studies including more and elder animals would provide a better view of head changes according to sex. The accumulation of basic morphological data would be important as future biological and veterinary knowledges. Comparison of sexual dimorphism and ontogenetic variation would be also of interest (to date no study on this topic is known) to compare equine breeds. Morphological growth variations in skull features according to putative geographical groups, would also be an interesting new line of research line.

In the present study, linear traits have been used. Landmark/outline-based geometric morphometric analyses must be considered to be more appropriate in assessing shape-related morphometric sexual variation than linear measurement-based traditional morphometric analysis, which is out of the scope of the present study.

Acknowledgments

The author thanks the abattoir MAFRISEU SA in La Seu d'Urgell (Catalonia, Spain) for providing the samples and the corresponding information.

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